

WHAT IS CLAIMED IS:

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1. A spin-valve type magnetoresistive sensor comprising, on a substrate, an antiferromagnetic layer; a pinned magnetic layer formed in contact with said antiferromagnetic layer and having a magnetization direction made stationary under an exchange anisotropic magnetic field generated by interaction with said antiferromagnetic layer; a non-magnetic electrically conductive layer formed between a free magnetic layer and said pinned magnetic layer; soft magnetic layers arranged on said free magnetic layer while a spacing corresponding to a track width is left between said soft magnetic layers; bias layers formed on said soft magnetic layers and acting to uniformly arrange a magnetization direction of said free magnetic layer in a direction crossing the magnetization direction of said pinned magnetic layer; and electrically conductive layers for applying a detection electric current to said free magnetic layer,

said antiferromagnetic layer and said bias layer being each made of an alloy containing at least one or more elements selected from among Pt, Pd, Rh, Ru, Ir, Os, Au, Ag, Cr, Ni, Ne, Ar, Xe and Kr, as well as Mn.

2. A spin-valve type magnetoresistive sensor according to Claim 1, wherein at least one of said pinned magnetic layer and said free magnetic layer is divided into two layers with a

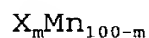
non-magnetic intermediate layer interposed between the two layers, and the divided two layers are held in a ferrimagnetic state where these layers are magnetized in directions 180° different from each other.

3. A spin-valve type magnetoresistive sensor according to Claim 1, wherein said antiferromagnetic layer is made of an alloy having the following composition formula;



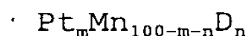
where X is at least one or more elements selected from among Pt, Pd, Rh, Ru, Ir and Os, and a composition ratio  $m$  satisfies  $48 \text{ atom \%} \leq m \leq 60 \text{ atom \%}$ .

4. A spin-valve type magnetoresistive sensor according to Claim 1, wherein said bias layer is made of an alloy having the following composition formula;



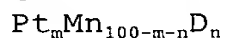
where X is at least one or more elements selected from among Pt, Pd, Rh, Ru, Ir and Os, and a composition ratio  $m$  satisfies  $48 \text{ atom \%} \leq m \leq 60 \text{ atom \%}$ .

5. A spin-valve type magnetoresistive sensor according to Claim 1, wherein said antiferromagnetic layer is made of an alloy having the following composition formula;



where D is at least one or more elements selected from among Pd, Rh, Ru, Ir and Os, and composition ratios  $m$ ,  $n$  satisfy  $48 \text{ atom \%} \leq m + n \leq 60 \text{ atom \%}$  and  $0.2 \text{ atom \%} \leq n \leq 40 \text{ atom \%}$ .

6. A spin-valve type magnetoresistive sensor according to Claim 1, wherein said bias layer is made of an alloy having the following composition formula;



where D is at least one or more elements selected from among Pd, Rh, Ru, Ir and Os, and composition ratios  $m$ ,  $n$  satisfy  $52 \text{ atom \%} \leq m + n \leq 60 \text{ atom \%}$  and  $0.2 \text{ atom \%} \leq n \leq 40 \text{ atom \%}$ .

7. A spin-valve type magnetoresistive sensor according to Claim 1, wherein said soft magnetic layer is made of a NiFe alloy.

8. A spin-valve type magnetoresistive sensor according to Claim 1, wherein recesses are formed in said free magnetic layer on both sides of an area corresponding to a track width, said soft magnetic layers are formed to fill said recesses and are directly joined to said free magnetic layer through bottom surfaces of said recesses, and said bias layers and said electrically conductive layers are successively formed on said soft magnetic layers.

9. A spin-valve type magnetoresistive sensor according to

Claim 1, wherein said free magnetic layer is divided into two layers with a non-magnetic intermediate layer interposed between the two layers, and wherein, assuming that one free magnetic layer farther away from said pinned magnetic layer is a first free magnetic layer and the other free magnetic layer closer to said pinned magnetic layer is a second free magnetic layer, a magnetic film thickness of said first free magnetic layer is smaller than a magnetic film thickness of said second free magnetic layer.

10. A method of manufacturing a spin-valve type magnetoresistive sensor comprising the steps of:

forming an antiferromagnetic layer, a pinned magnetic layer, a non-magnetic electrically conductive layer, and a free magnetic layer successively on a substrate, thereby forming a first laminate;

heat-treating said first laminate at a first heat treatment temperature while applying a first magnetic field in a direction perpendicular to a direction of a track width, thereby generating an exchange anisotropic magnetic field in said antiferromagnetic layer to make magnetization of said pinned magnetic layer stationary;

forming soft magnetic layers on said first laminate while a spacing corresponding to the track width is left between said soft magnetic layers, forming bias layers on said soft magnetic

layers, and forming electrically conductive layers on said bias layers for applying a detection electric current to said free magnetic layer, thereby forming a second laminate; and

heat-treating said second laminate at a second heat treatment temperature while applying a second magnetic field smaller than the exchange anisotropic magnetic field of said antiferromagnetic layer in a direction of the track width, thereby imparting a bias magnetic field to said free magnetic layer in a direction crossing a magnetization direction of said pinned magnetic layer.

11. A method of manufacturing a spin-valve type magnetoresistive sensor according to Claim 10, wherein said antiferromagnetic layer and said bias layers are each made of an alloy containing at least one or more elements selected from among Pt, Pd, Rh, Ru, Ir, Os, Au, Ag, Cr, Ni, Ne, Ar, Xe and Kr, as well as Mn.

12. A method of manufacturing a spin-valve type magnetoresistive sensor according to Claim 10, wherein said first heat treatment temperature is in a range of 220°C - 270°C.

13. A method of manufacturing a spin-valve type magnetoresistive sensor according to Claim 10, wherein said second heat treatment temperature is in a range of 250°C - 270°C.

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